Using complementation and resequencing to minimize transitions

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Abstract

In (Murgai et al., 1997) the following problem was addressed: given a set of **data** words or messages to be transmitted over a **bus** such that the sequence (order) in which they are transmitted is irrelevant, determine the optimum sequence that minimizes the total number of transitions on the bus. Stan and Burleson (1994) presented the **bus**-invert method as a means of encoding words for reducing I/O power, in which a word may be inverted and then transmitted if doing so reduces the number of transitions. In this paper, we combine the two paradigms into one-that of sequencing words under the **bus**-invert scheme for the minimum transitions, i.e., words can be **complemented**, reordered and then transmitted. We prove that this problem DOPI-**Data** Ordering Problem with Inversion-is NP-complete. We present a polynomial-time approximation algorithm to solve DOPI that comes within a factor of 1.5 from the optimum. Experimental results show that, on average, the solutions generated by our algorithm were within 4.4% of the optimum, and that resequencing along with complementation leads to 34.4% reduction in switching activity.

Index Terms

Inspec

Controlled Indexing

computational complexity graph theory minimisation scheduling switching theory system buses

Non-controlled Indexing

DOPI Data Ordering Problem with Inversion NP-complete bus-invert method complementation encoding optimum sequence polynomial-time approximation algorithm resequencing system bus transition minimization

Author Keywords

Not Available

References

No references available on IEEE Xplore.

Citing Documents

Refine Search

Search Results -

Terms	Documents
(327/518 |370/464 |370/476 |710/305 |710/100 |710/34 |710/65 |712/220 |713/502 |365/49 |365/63 |365/190 |365/233.5 |365/205 |326/35 |326/86).ccls.	13372

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L4	l1 and L3	143	L4
L3	L2 and (threshold or limit)	3619	L3
L2	count$3 near10 data near10 bus	6764	L2
L1	710/305,100,34,65;365/49,63,190,233.5,205;713/502;327/518;326/35,86;370/464,476;712/220.ccls.	13372	L1

END OF SEARCH HISTORY

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Terms	Documents
L1 and L3	2

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L4	l1 and L3	2	L4
L3	complementing same data same bus same (threshold or limit)	5	L3
L2	complementing near10 data near10 bus near10 (threshold or limit)	1	L2
L1	count$3 near10 data near10 bus	6764	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
L1 and L3	0

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Search: L5

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Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
DB=EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L5	l1 and L3	0	L5
DB=PGPB,USPT,USOC; PLUR=YES; OP=OR			
L4	l1 and L3	2	L4
L3	complementing same data same bus same (threshold or limit)	5	L3
L2	complementing near10 data near10 bus near10 (threshold or limit)	1	L2
L1	count$3 near10 data near10 bus	6764	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
L1 and L6	31

Database:

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Search: L7

Refine Search

Recall Text Clear Interrupt

Search History

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Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
DB=PGPB,USPT,USOC; PLUR=YES; OP=OR			
L7	l1 and L6	31	L7
L6	complementing same data same bus	200	L6
DB=EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L5	l1 and L3	0	L5
DB=PGPB,USPT,USOC; PLUR=YES; OP=OR			
L4	l1 and L3	2	L4
L3	complementing same data same bus same (threshold or limit)	5	L3
L2	complementing near10 data near10 bus near10 (threshold or limit)	1	L2
L1	count$3 near10 data near10 bus	6764	L1

END OF SEARCH HISTORY

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File View Edit Tools Window Help

- Drafts
- Pending
- Active
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  - L2: (25) l1 same (thres
- Failed
- Saved
- Favorites
- Tagged (0)
- UDC
- Queue
- Trash

Search List Browse Queue Clear

DBs USPAT

Plurals

Default operator: OR

Highlight all hit terms initially

BRS form | IS&R form | Image | Text | HTML

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1	BRS	L1	1265	(complement$3 or negat$3 or inverse) n	USPAT	2005/11/17 10:44			
2	BRS	L2	25	l1 same (threshold or limit)	USPAT	2005/11/17 10:44			

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File View Edit Tools Window Help

- Drafts
- Pending
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  - L1: (1265) (complement
  - L2: (25) l1 same (thre
- Failed
- Saved
- Favorites
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DBs USPAT

Plurals

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l1 same (threshold or limit)

BRS form IS&R form Image Text HTML

	U	I	Document ID	Issue Dat	Pages	Title	Current OR	Current X
1	☐	☐	US 6898648 B2	20050524	16	Memory bus polarity indicator system and me	710/100	365/189.0
2	☐	☐	US 6766395 B1	20040720	9	Extended common mode differential driver	710/100	327/520; 710/305;
3	☐	☐	US 6091662 A	20000718	15	Semiconductor synchronous pipeline me	365/233	365/205; 365/63
4	☐	☐	US 5742185 A	19980421	7	Data bus drive circuit for semiconductor memor	326/86	326/93; 365/203
5	☐	☐	US 5696725 A	19971209	8	High-speed sense amplifier for semicondu	365/205	365/189.0 ;
6	☐	☐	US 5633828 A	19970527	15	Circuitry and methodology to test sin	365/201	365/190
7	☐	☐	US 5487070 A	19960123	29	Apparatus for reproducing received da	370/517	370/507; 375/359
8	☐	☐	US 5222041 A	19930622	11	Data amplifying system in semiconductor memory	365/189.01	365/204; 365/207
9	☐	☐	US 5119335 A	19920602	15	Semiconductor static memory device	365/190	365/189.1
10	☐	☐	US 5088065 A	19920211	15	Static type semiconductor memory	365/208	365/189.0 ;
11	☐	☐	US 5019720	19910528	19	Integrated circuit	327/108	326/104;

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Results for "((complementing<in>metadata) <and> (data<in>metadata))<and> (bus<i..."

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» Key

IEEE JNL	IEEE Journal or Magazine
IEE JNL	IEE Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IEE CNF	IEE Conference Proceeding
IEEE STD	IEEE Standard

Modify Search

((complementing<in>metadata) <and> (data<in>metadata))<and> (bus<in>meta

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1. **Sign bit reduction encoding for low power applications**
Saneei, M.; Afzali-Kusha, A.; Navabi, Z.;
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13-17 June 2005 Page(s):214 - 217
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Controlled Indexing

computational complexity graph theory minimisation scheduling switching theory system **buses**

Non-controlled Indexing

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Author Keywords

Not Available

References

No references available on IEEE Xplore.

Citing Documents

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